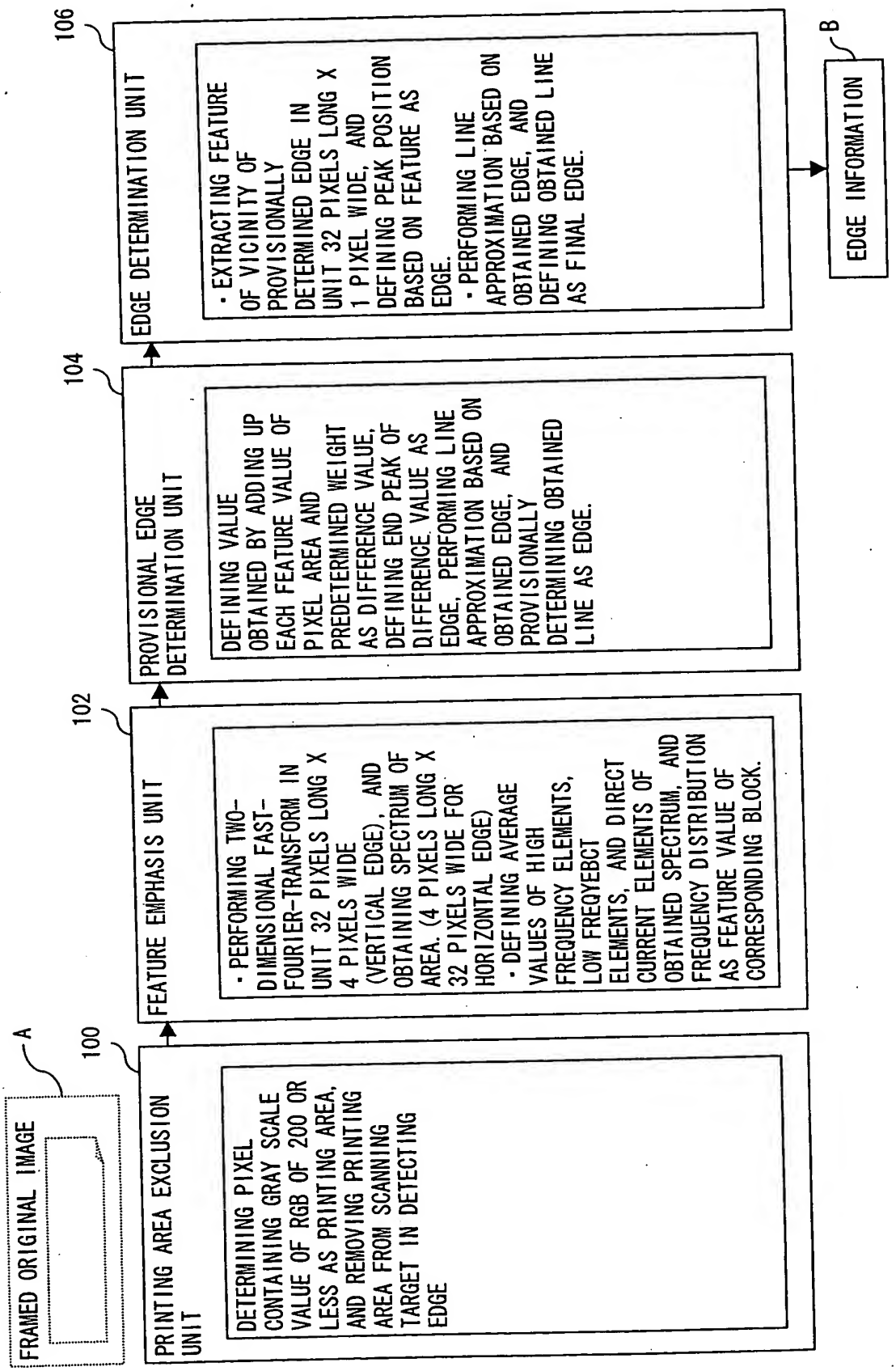

FRAMED ORIGINAL IMAGE
A
100
PRINTING AREA EXCLUSION UNIT
DETERMINING PIXEL CONTAINING GRAY SCALE VALUE OF RGB OF 200 OR LESS AS PRINTING AREA, AND REMOVING PRINTING AREA FROM SCANNING TARGET IN DETECTING EDGE
102
FEATURE EMPHASIS UNIT
・PERFORMING TWO-DIMENSIONAL FAST-FOURIER-TRANSFORM IN UNIT 32 PIXELS LONG X 4 PIXELS WIDE (VERTICAL EDGE), AND OBTAINING SPECTRUM OF AREA. (4 PIXELS LONG X 32 PIXELS WIDE FOR HORIZONTAL EDGE)
・DEFINING AVERAGE VALUES OF HIGH FREQUENCY ELEMENTS, LOW FREQYEBCT ELEMENTS, AND DIRECT CURRENT ELEMENTS OF OBTAINED SPECTRUM, AND FREQUENCY DISTRIBUTION AS FEATURE VALUE OF CORRESPONDING BLOCK.
104
PROVISIONAL EDGE DETERMINATION UNIT
DEFINING VALUE OBTAINED BY ADDING UP EACH FEATURE VALUE OF PIXEL AREA AND PREDETERMINED WEIGHT AS DIFFERENCE VALUE, DEFINING END PEAK OF DIFFERENCE VALUE AS EDGE, PERFORMING LINE APPROXIMATION BASED ON OBTAINED EDGE, AND PROVISIONALLY DETERMINING OBTAINED LINE AS EDGE.
106
EDGE DETERMINATION UNIT
・EXTRACTING FEATURE OF VICINITY OF PROVISIONALLY DETERMINED EDGE IN UNIT 32 PIXELS LONG X 1 PIXEL WIDE, AND DEFINING PEAK POSITION BASED ON FEATURE AS EDGE.
・PERFORMING LINE APPROXIMATION BASED ON OBTAINED EDGE, AND DEFINING OBTAINED LINE AS FINAL EDGE.
B
EDGE INFORMATION

FIG. 1

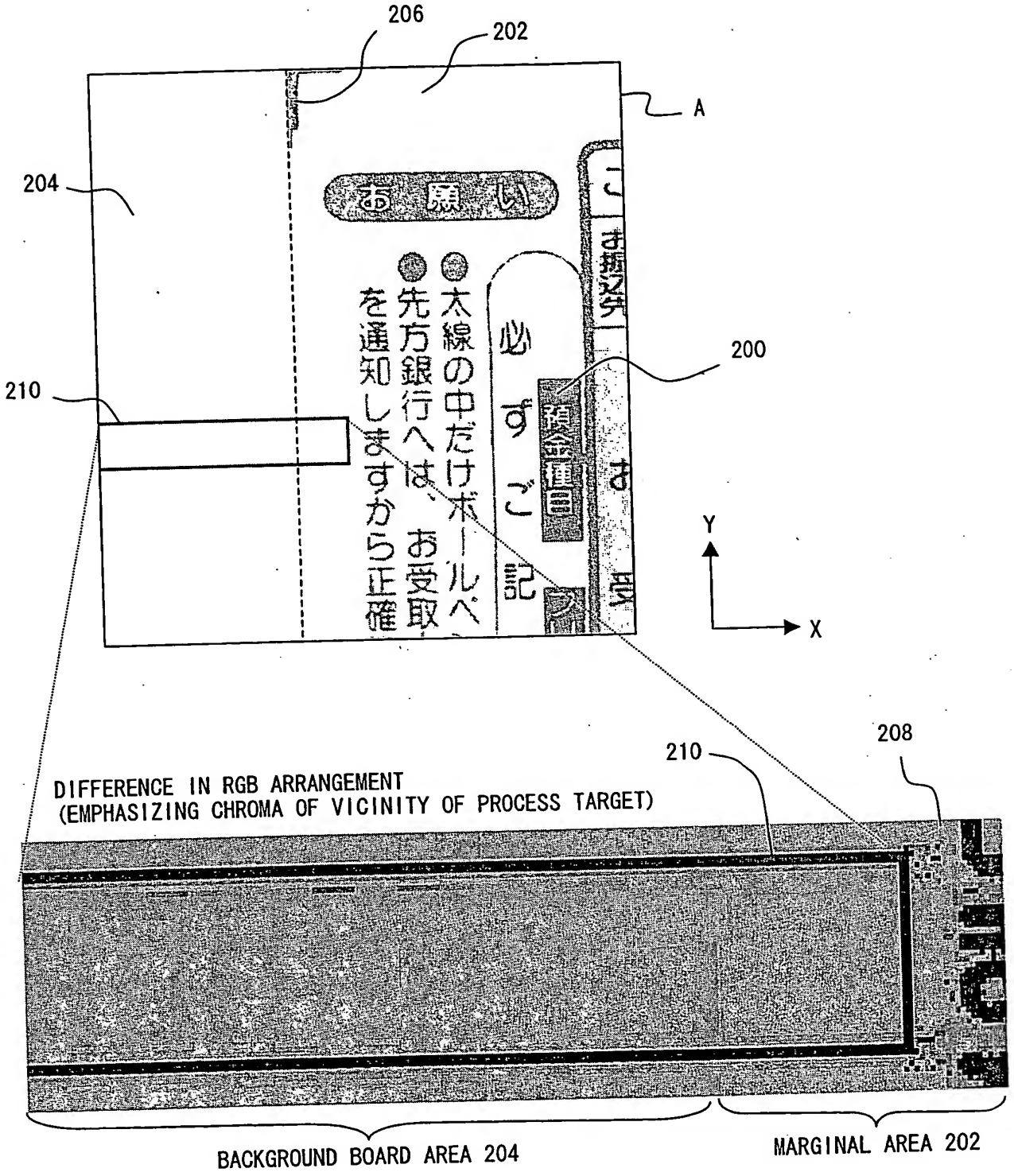

206
202
A
204
200
210
Y
X
208
210
DIFFERENCE IN RGB ARRANGEMENT
(EMPHASIZING CHROMA OF VICINITY OF PROCESS TARGET)
BACKGROUND BOARD AREA 204
MARGINAL AREA 202

FIG. 2

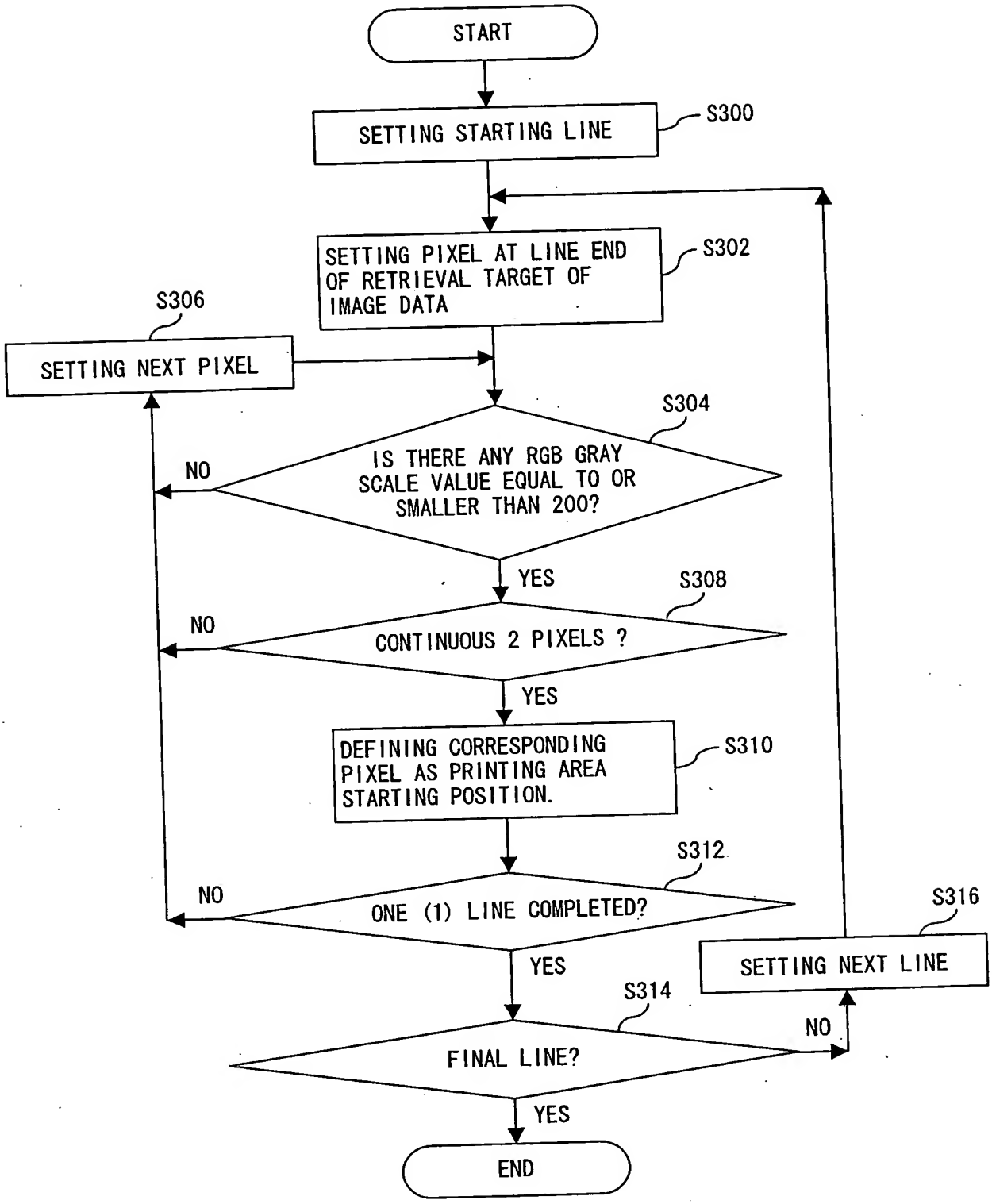

START
SETTING STARTING LINE
S300
SETTING PIXEL AT LINE END OF RETRIEVAL TARGET OF IMAGE DATA
S302
S306
SETTING NEXT PIXEL
S304
IS THERE ANY RGB GRAY SCALE VALUE EQUAL TO OR SMALLER THAN 200?
NO
YES
S308
CONTINUOUS 2 PIXELS ?
NO
YES
DEFINING CORRESPONDING PIXEL AS PRINTING AREA STARTING POSITION.
S310
S312
ONE (1) LINE COMPLETED?
NO
YES
S316
SETTING NEXT LINE
S314
FINAL LINE?
NO
YES
END

FIG. 3

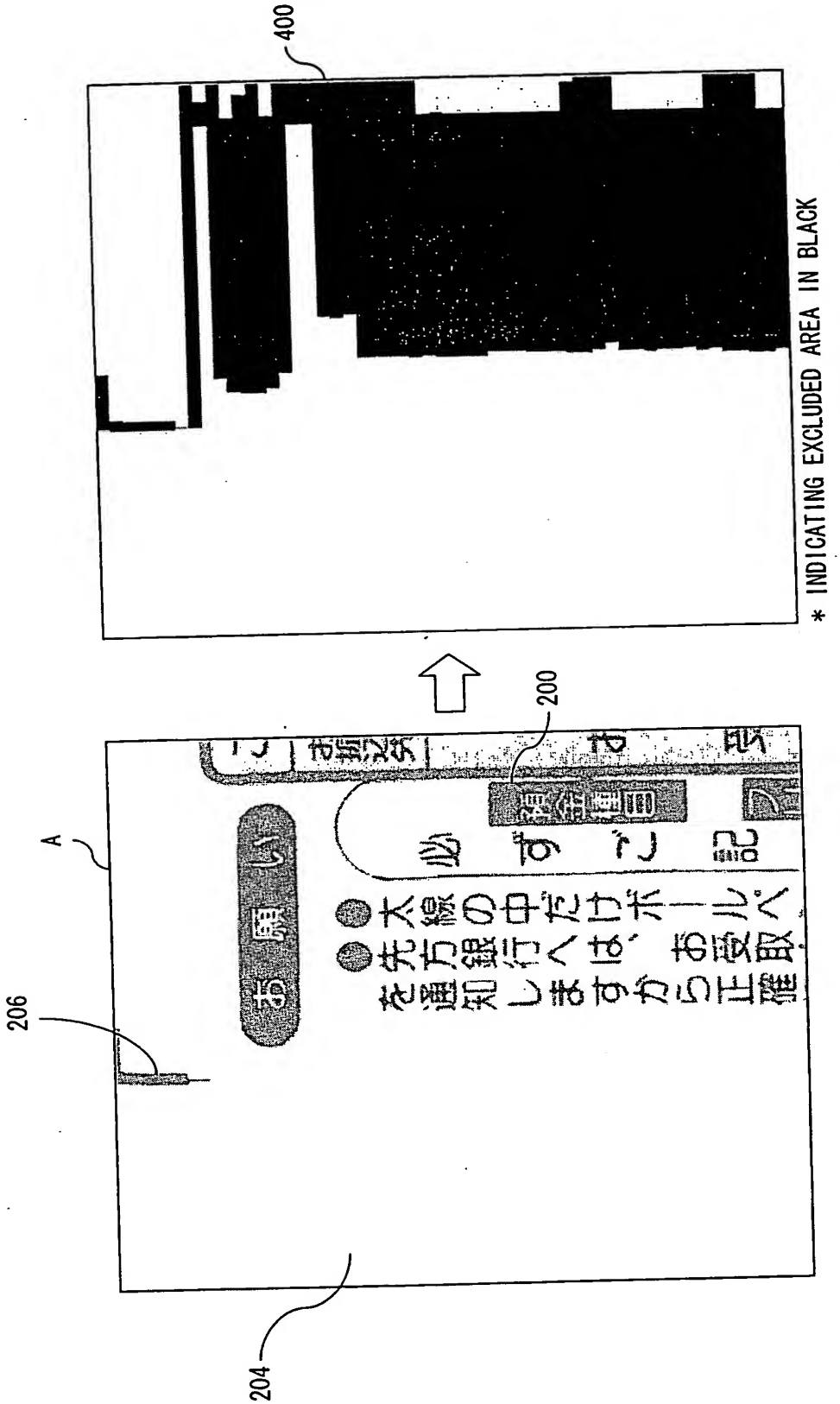


FIG. 4B

FIG. 4A

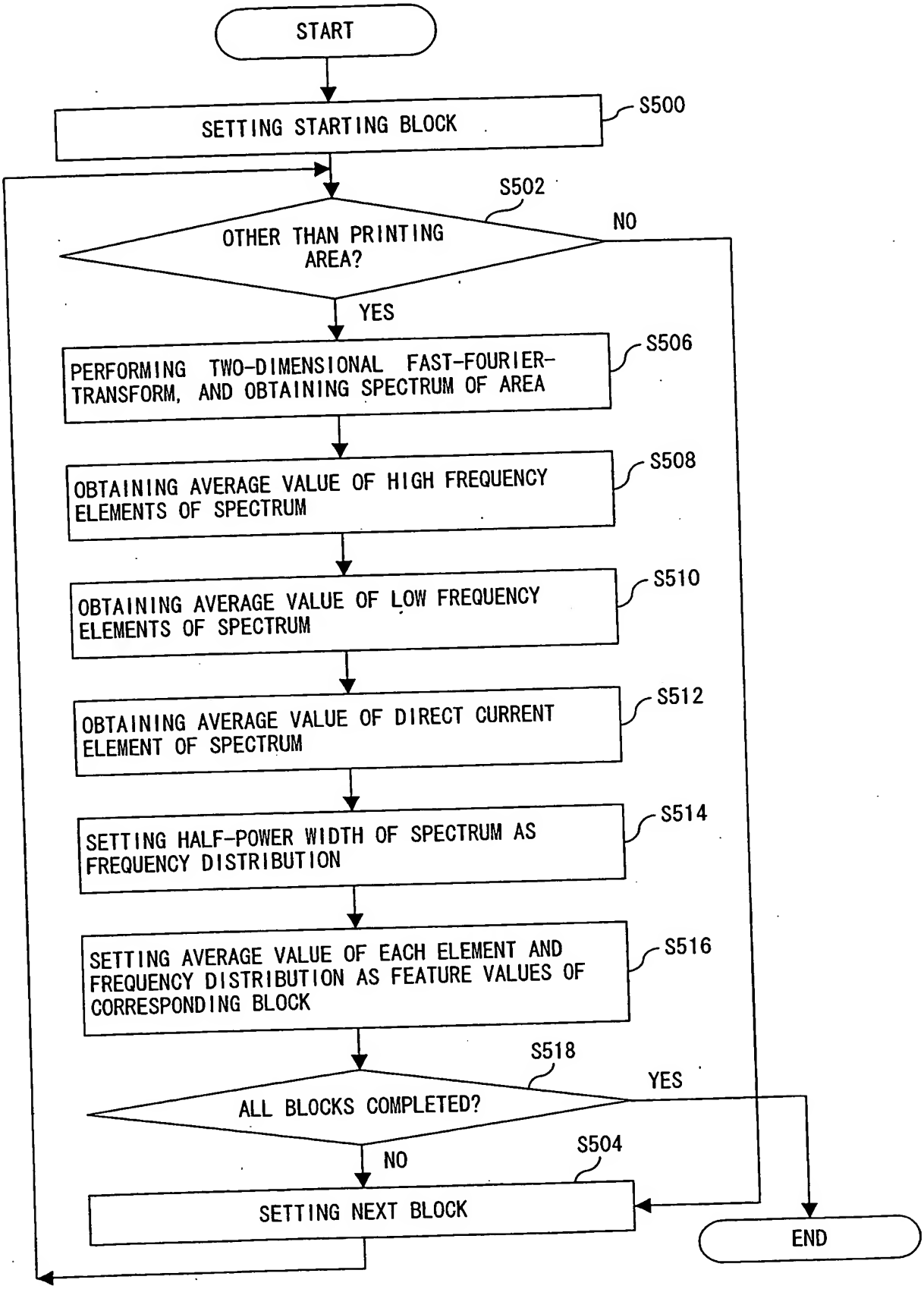

START
SETTING STARTING BLOCK
S500
S502
OTHER THAN PRINTING AREA?
NO
YES
PERFORMING TWO-DIMENSIONAL FAST-FOURIER-TRANSFORM, AND OBTAINING SPECTRUM OF AREA
S506
OBTAINING AVERAGE VALUE OF HIGH FREQUENCY ELEMENTS OF SPECTRUM
S508
OBTAINING AVERAGE VALUE OF LOW FREQUENCY ELEMENTS OF SPECTRUM
S510
OBTAINING AVERAGE VALUE OF DIRECT CURRENT ELEMENT OF SPECTRUM
S512
SETTING HALF-POWER WIDTH OF SPECTRUM AS FREQUENCY DISTRIBUTION
S514
SETTING AVERAGE VALUE OF EACH ELEMENT AND FREQUENCY DISTRIBUTION AS FEATURE VALUES OF CORRESPONDING BLOCK
S516
S518
ALL BLOCKS COMPLETED?
YES
NO
S504
SETTING NEXT BLOCK
END

FIG. 5

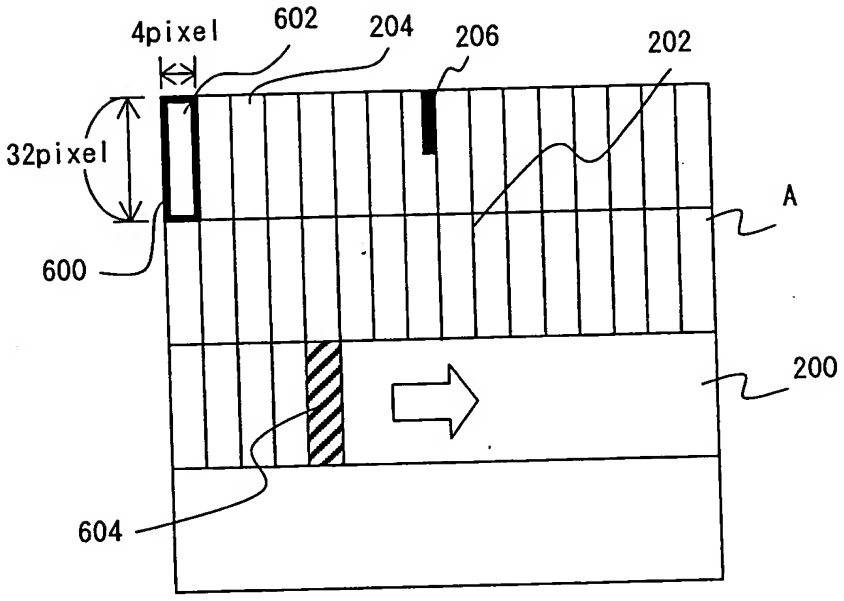


FIG. 6

X COORDINATE	DIRECT CURRENT ELEMENT R	DIRECT CURRENT ELEMENT G	DIRECT CURRENT ELEMENT B	LOW FREQUENCY ELEMENT R	LOW FREQUENCY ELEMENT G	LOW FREQUENCY ELEMENT B	HIGH FREQUENCY ELEMENT R	HIGH FREQUENCY ELEMENT G	HIGH FREQUENCY ELEMENT B
0	251	255	255	0.35	0.13	0.00	0.312482	0.105303	0.000000
4	251	254	255	0.35	0.16	0.02	0.317167	0.163026	0.018861
8	252	254	255	0.35	0.18	0.05	0.305198	0.157446	0.054425
12	252	254	255	0.32	0.15	0.00	0.291552	0.131851	0.000000
16	252	255	255	0.34	0.13	0.03	0.269472	0.140766	0.031250
20	252	255	255	0.30	0.12	0.02	0.316194	0.113653	0.019831
24	251	254	255	0.40	0.17	0.00	0.326063	0.162740	0.000000
28	252	255	255	0.31	0.11	0.02	0.323525	0.083686	0.018861
32	251	255	255	0.38	0.10	0.03	0.328309	0.095564	0.000000
36	252	255	255	0.33	0.10	0.00	0.335016	0.091632	0.039275
40	252	254	255	0.30	0.17	0.04	0.313465	0.165461	0.000000
44	252	254	255	0.33	0.11	0.00	0.281654	0.093890	0.000000
48	252	255	255	0.33	0.14	0.00	0.231198	0.121620	0.020326
52	252	255	255	0.33	0.11	0.02	0.282260	0.127697	0.000000
56	251	254	255	0.36	0.18	0.00	0.267413	0.145008	0.000000
60	252	255	255	0.31	0.14	0.00	0.329278	0.112263	0.018143
64	253	254	255	0.26	0.15	0.02	0.250985	0.131220	0.000000
68	252	254	255	0.34	0.13	0.00	0.307986	0.119091	0.000000
72	251	254	255	0.35	0.15	0.00	0.322422	0.106955	0.000000
76	252	255	255	0.29	0.17	0.03	0.247658	0.136985	0.000000
80	252	255	255	0.34	0.11	0.00	0.282899	0.104349	0.000000
84	252	255	255	0.29	0.11	0.00	0.278326	0.099585	0.000000
88	252	255	255	0.32	0.09	0.00	0.295241	0.087684	0.000000
92	253	255	255	0.25	0.11	0.00	0.251675	0.087597	0.000000
96	253	255	255	0.31	0.10	0.00	0.270370	0.087871	0.000000
100	253	254	255	0.23	0.15	0.02	0.233297	0.143751	0.000000
104	253	255	255	0.25	0.10	0.00	0.222948	0.086416	0.018073
108	253	255	255	0.29	0.11	0.00	0.234780	0.100877	0.000000
112	254	255	255	0.21	0.08	0.03	0.157112	0.057389	0.000000
116	254	255	255	0.20	0.05	0.00	0.146726	0.019831	0.312500
120	254	255	255	0.22	0.07	0.00	0.193532	0.075189	0.000000
124	254	255	255	0.19	0.08	0.00	0.176843	0.080868	0.000000
128	252	254	255	0.30	0.13	0.03	0.254739	0.124054	0.000000
132	253	254	255	0.28	0.23	0.11	0.232993	0.178666	0.108077
136	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
140	255	255	255	0.02	0.00	0.00	0.000000	0.000000	0.000000
144	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
148	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
152	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
156	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
160	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
164	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000
168	255	255	255	0.00	0.00	0.00	0.000000	0.000000	0.000000

FIG. 7

Title: BOUNDARY DETECTION METHOD BETWEEN AREAS HAVING DIFFERENT FEATURES IN IMAGE DATA
By: Shinichi EGUCHI et al.
Docket No.: 031288

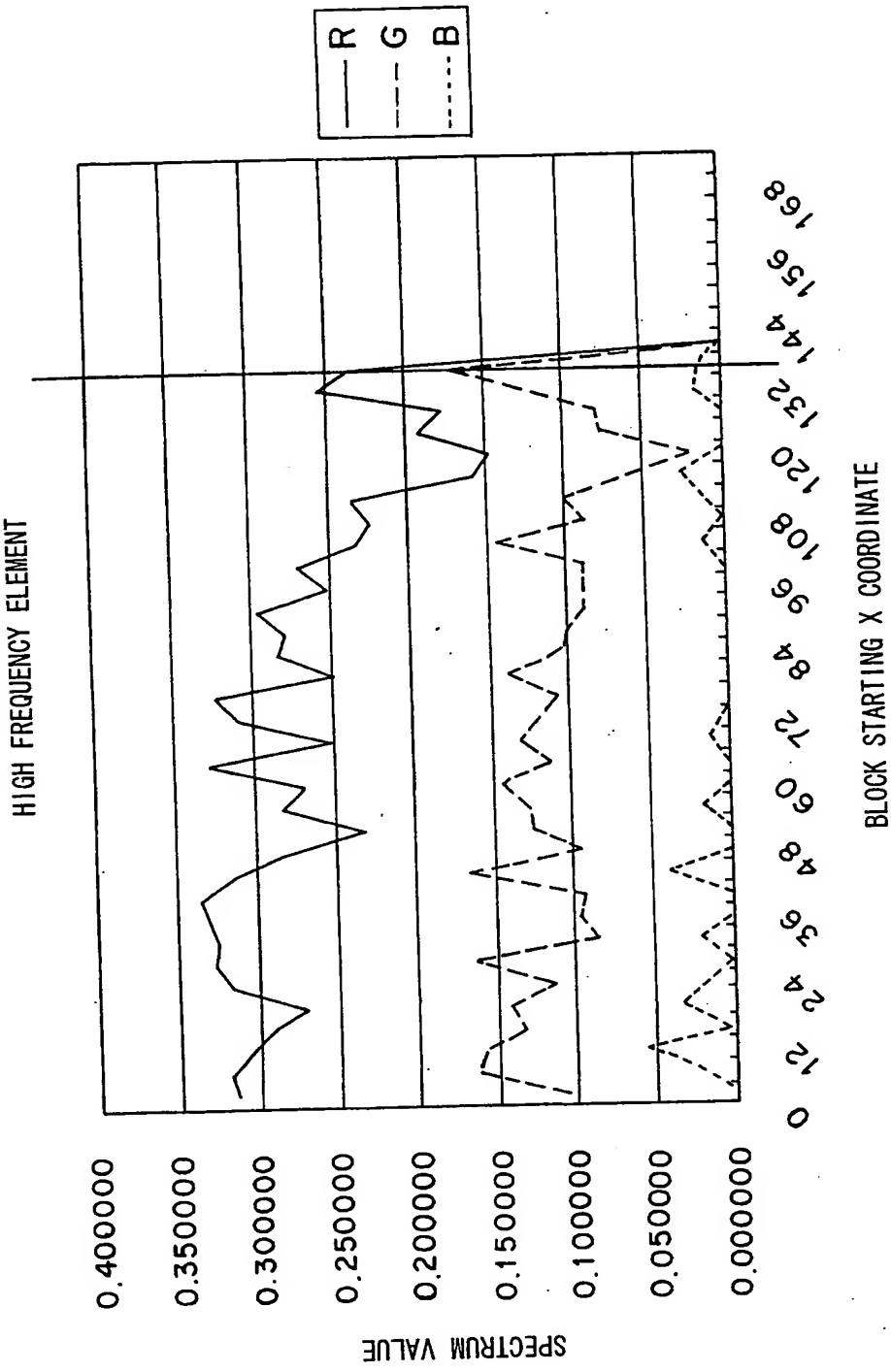

R
G
B
HIGH FREQUENCY ELEMENT
SPECTRUM VALUE
0.400000
0.350000
0.300000
0.250000
0.200000
0.150000
0.100000
0.050000
0.000000
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
BLOCK STARTING X COORDINATE

FIG. 8

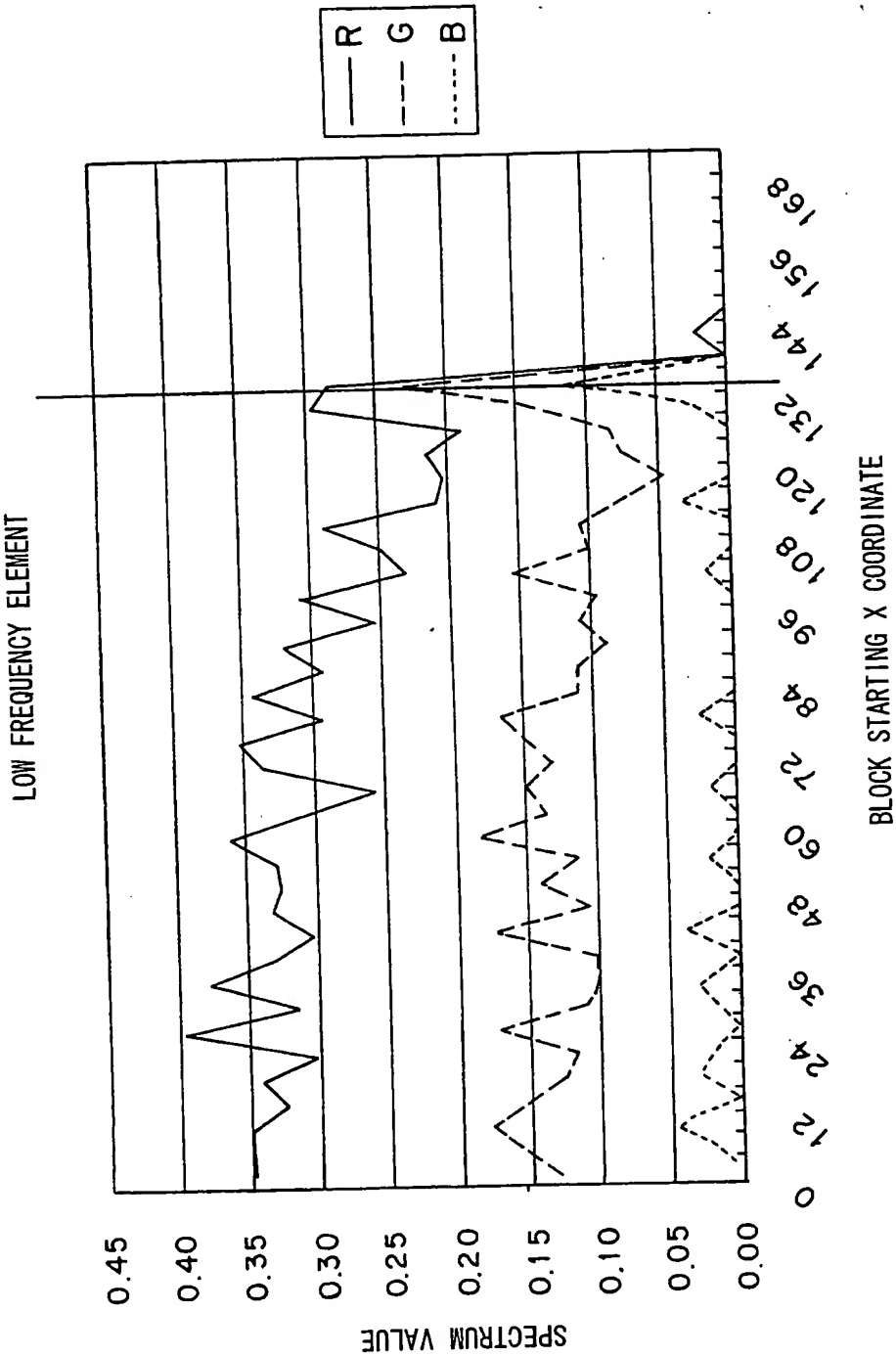

R
G
B
LOW FREQUENCY ELEMENT
SPECTRUM VALUE
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
BLOCK STARTING X COORDINATE

FIG. 9

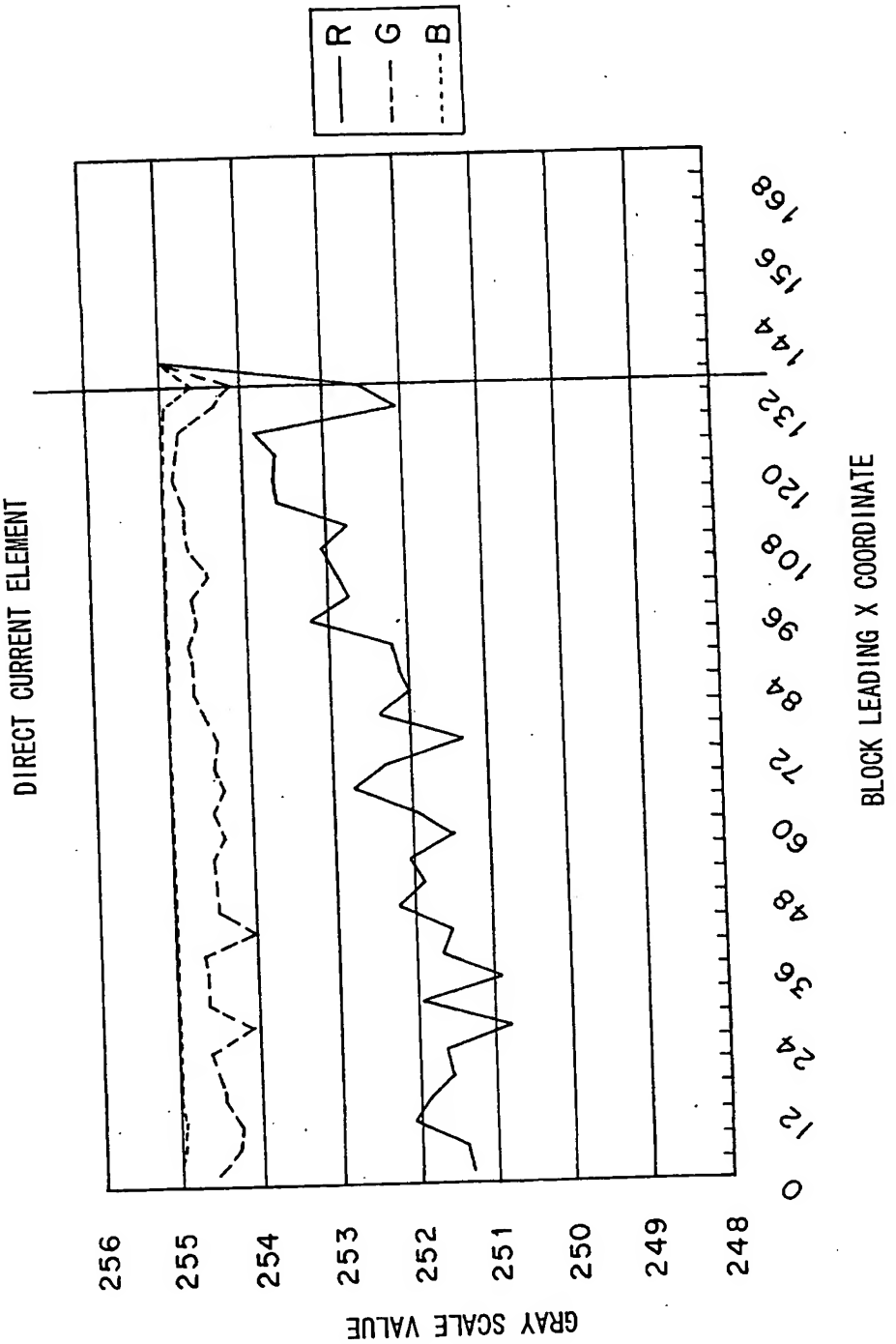

R
G
B
DIRECT CURRENT ELEMENT
GRAY SCALE VALUE
256
255
254
253
252
251
250
249
248
BLOCK LEADING X COORDINATE
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168

FIG. 10

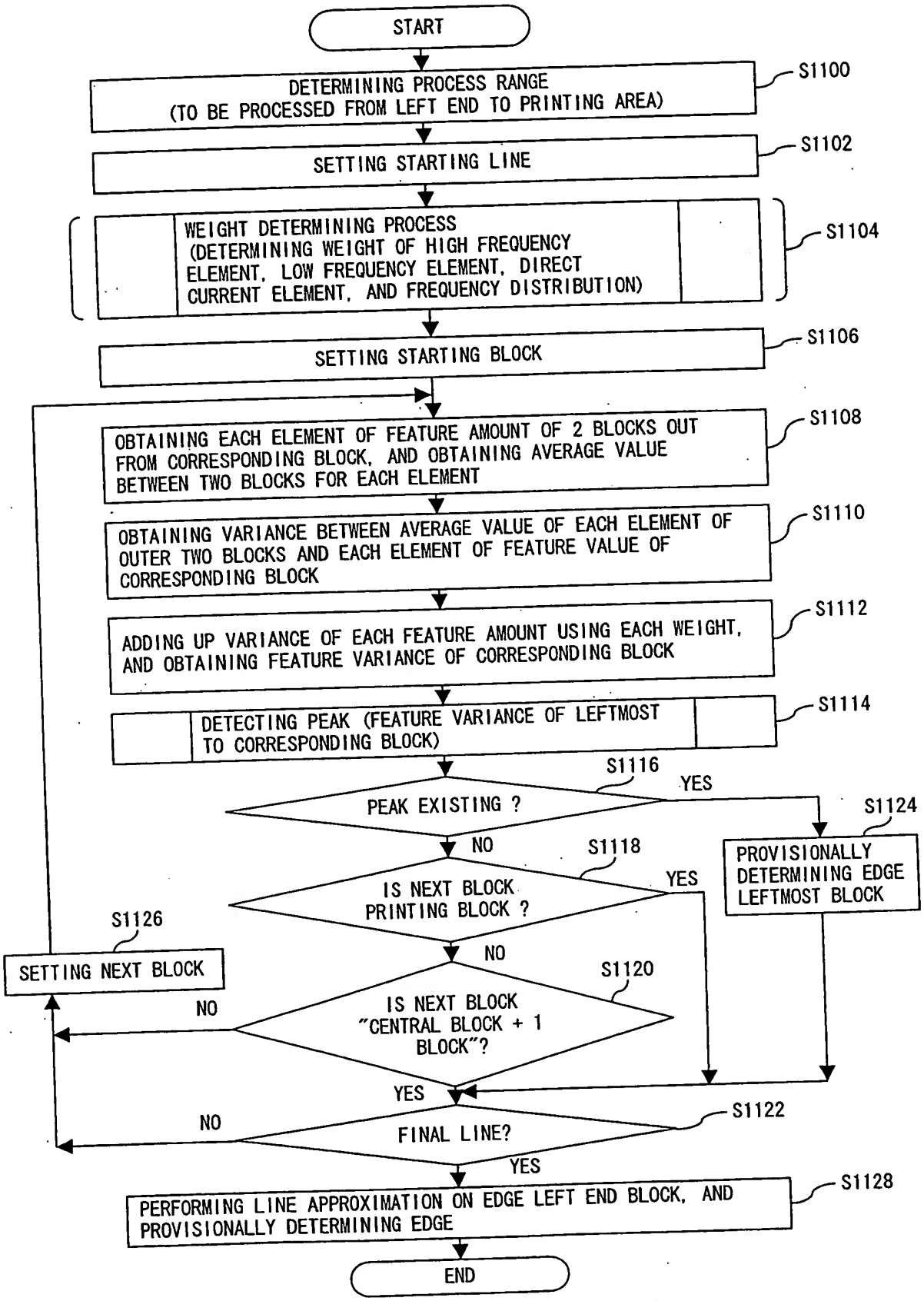

START
DETERMINING PROCESS RANGE (TO BE PROCESSED FROM LEFT END TO PRINTING AREA)
S1100
SETTING STARTING LINE
S1102
WEIGHT DETERMINING PROCESS (DETERMINING WEIGHT OF HIGH FREQUENCY ELEMENT, LOW FREQUENCY ELEMENT, DIRECT CURRENT ELEMENT, AND FREQUENCY DISTRIBUTION)
S1104
SETTING STARTING BLOCK
S1106
OBTAINING EACH ELEMENT OF FEATURE AMOUNT OF 2 BLOCKS OUT FROM CORRESPONDING BLOCK, AND OBTAINING AVERAGE VALUE BETWEEN TWO BLOCKS FOR EACH ELEMENT
S1108
OBTAINING VARIANCE BETWEEN AVERAGE VALUE OF EACH ELEMENT OF OUTER TWO BLOCKS AND EACH ELEMENT OF FEATURE VALUE OF CORRESPONDING BLOCK
S1110
ADDING UP VARIANCE OF EACH FEATURE AMOUNT USING EACH WEIGHT, AND OBTAINING FEATURE VARIANCE OF CORRESPONDING BLOCK
S1112
DETECTING PEAK (FEATURE VARIANCE OF LEFTMOST TO CORRESPONDING BLOCK)
S1114
S1116
PEAK EXISTING ?
YES
S1124
PROVISIONALLY DETERMINING EDGE LEFTMOST BLOCK
NO
S1118
IS NEXT BLOCK PRINTING BLOCK ?
YES
S1126
SETTING NEXT BLOCK
NO
S1120
IS NEXT BLOCK "CENTRAL BLOCK + 1 BLOCK"?
NO
YES
S1122
FINAL LINE?
NO
YES
S1128
PERFORMING LINE APPROXIMATION ON EDGE LEFT END BLOCK, AND PROVISIONALLY DETERMINING EDGE
END

FIG. 11

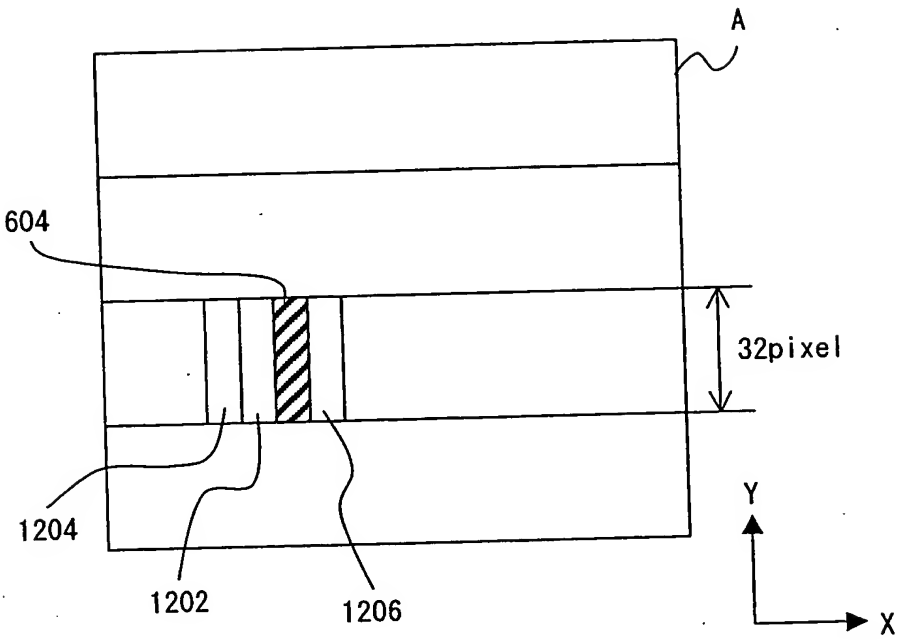


FIG. 12

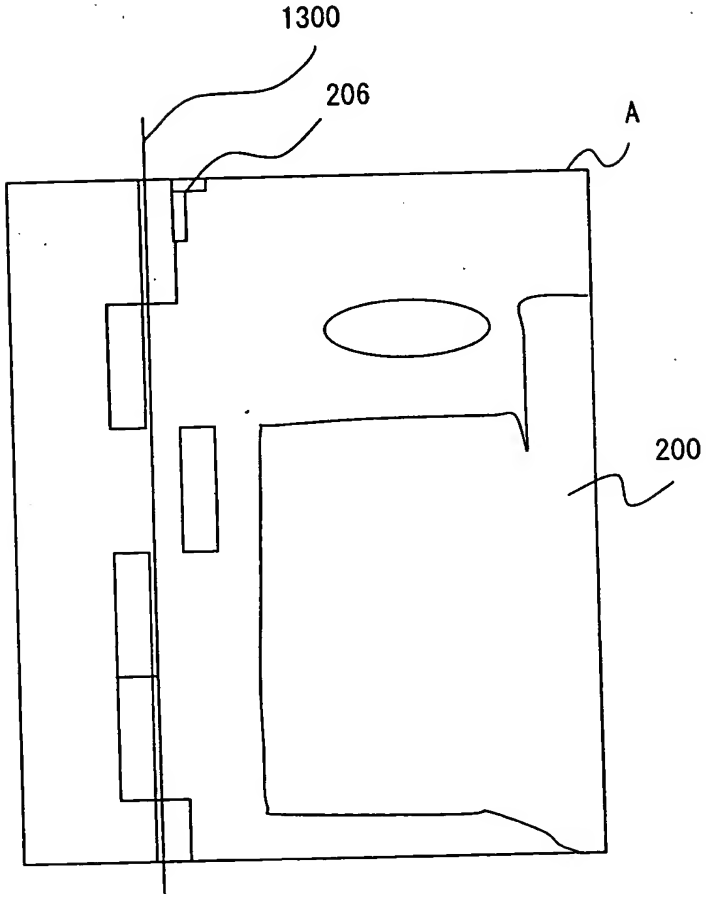


FIG. 13

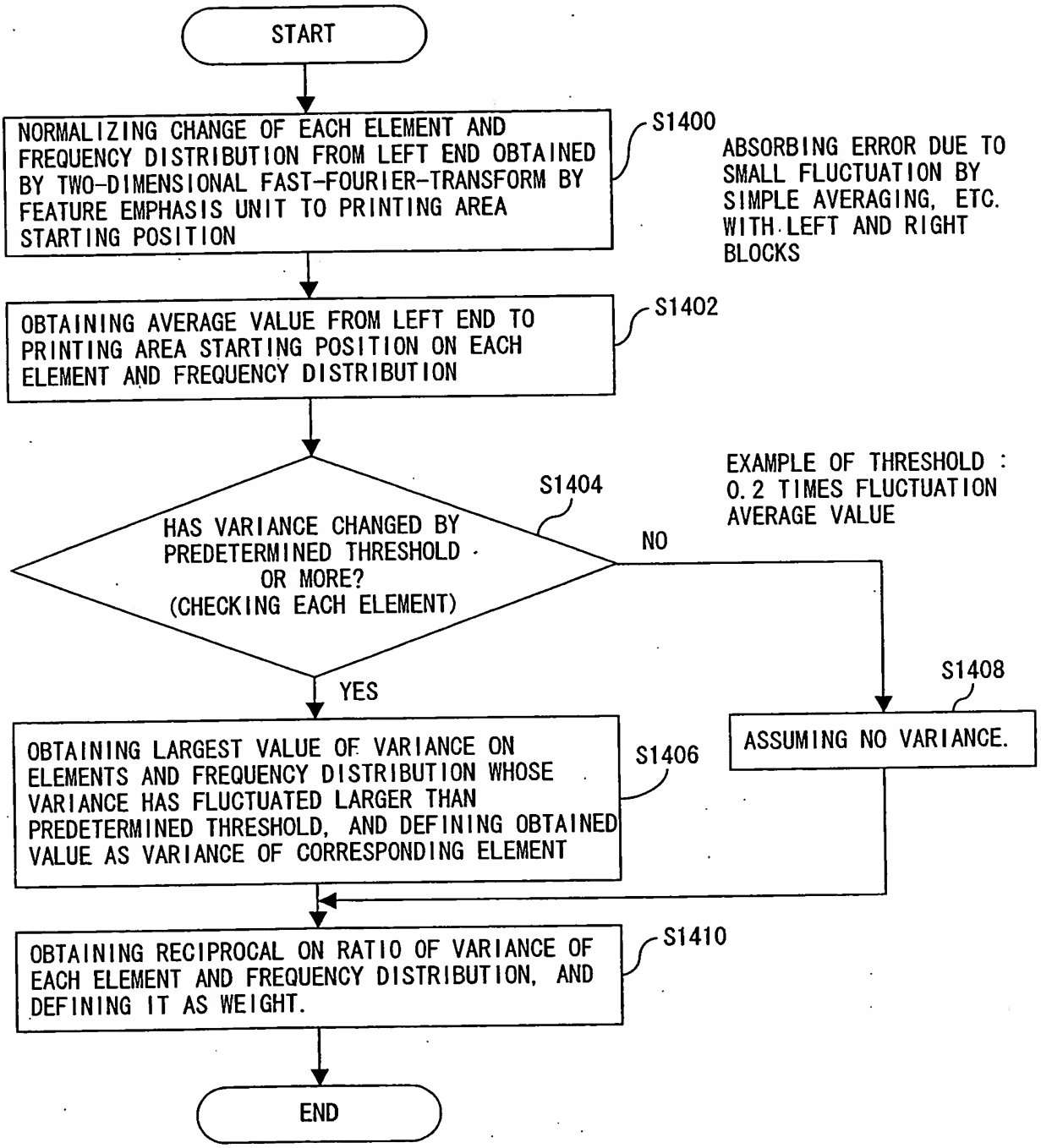

START
NORMALIZING CHANGE OF EACH ELEMENT AND FREQUENCY DISTRIBUTION FROM LEFT END OBTAINED BY TWO-DIMENSIONAL FAST-FOURIER-TRANSFORM BY FEATURE EMPHASIS UNIT TO PRINTING AREA STARTING POSITION
S1400
ABSORBING ERROR DUE TO SMALL FLUCTUATION BY SIMPLE AVERAGING, ETC. WITH LEFT AND RIGHT BLOCKS
OBTAINING AVERAGE VALUE FROM LEFT END TO PRINTING AREA STARTING POSITION ON EACH ELEMENT AND FREQUENCY DISTRIBUTION
S1402
HAS VARIANCE CHANGED BY PREDETERMINED THRESHOLD OR MORE? (CHECKING EACH ELEMENT)
S1404
EXAMPLE OF THRESHOLD : 0.2 TIMES FLUCTUATION AVERAGE VALUE
NO
YES
OBTAINING LARGEST VALUE OF VARIANCE ON ELEMENTS AND FREQUENCY DISTRIBUTION WHOSE VARIANCE HAS FLUCTUATED LARGER THAN PREDETERMINED THRESHOLD, AND DEFINING OBTAINED VALUE AS VARIANCE OF CORRESPONDING ELEMENT
S1406
ASSUMING NO VARIANCE.
S1408
OBTAINING RECIPROCAL ON RATIO OF VARIANCE OF EACH ELEMENT AND FREQUENCY DISTRIBUTION, AND DEFINING IT AS WEIGHT.
S1410
END

FIG. 14

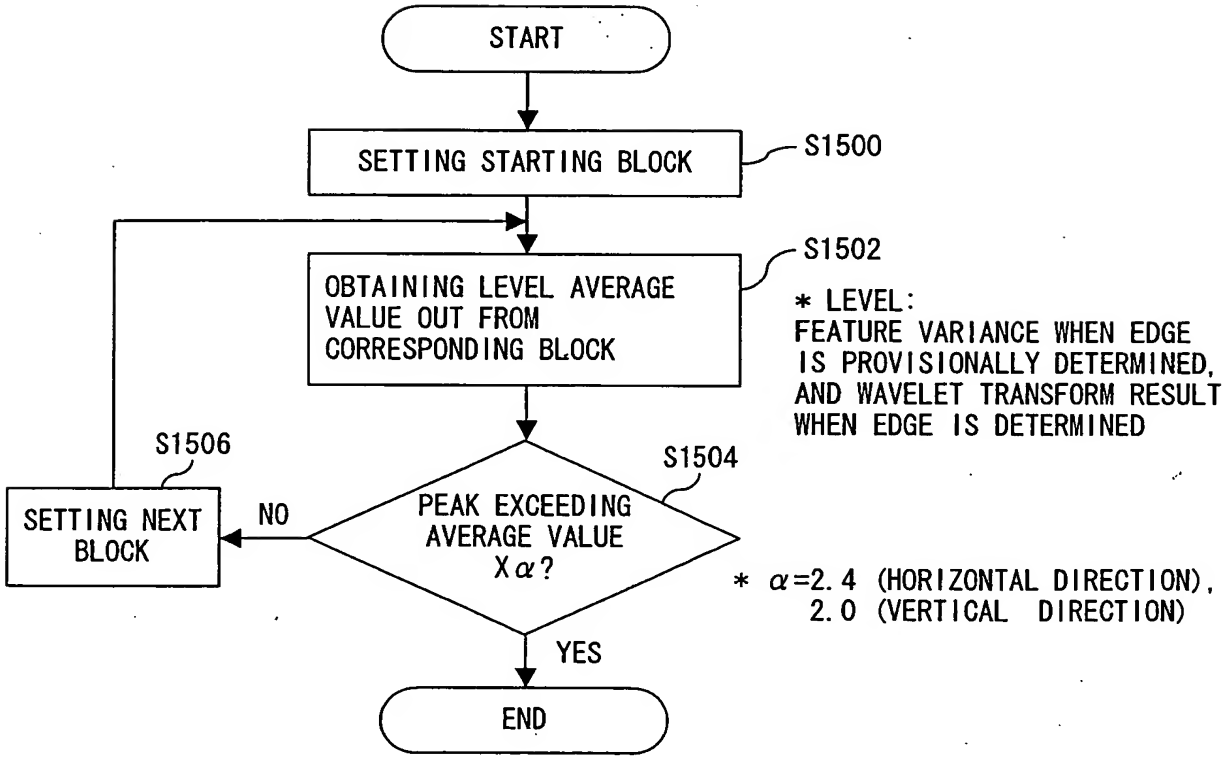

START
SETTING STARTING BLOCK
S1500
OBTAINING LEVEL AVERAGE VALUE OUT FROM CORRESPONDING BLOCK
S1502
* LEVEL:
FEATURE VARIANCE WHEN EDGE IS PROVISIONALLY DETERMINED, AND WAVELET TRANSFORM RESULT WHEN EDGE IS DETERMINED
S1504
PEAK EXCEEDING AVERAGE VALUE Xα?
NO
S1506
SETTING NEXT BLOCK
YES
END
* α=2.4 (HORIZONTAL DIRECTION), 2.0 (VERTICAL DIRECTION)

FIG. 15

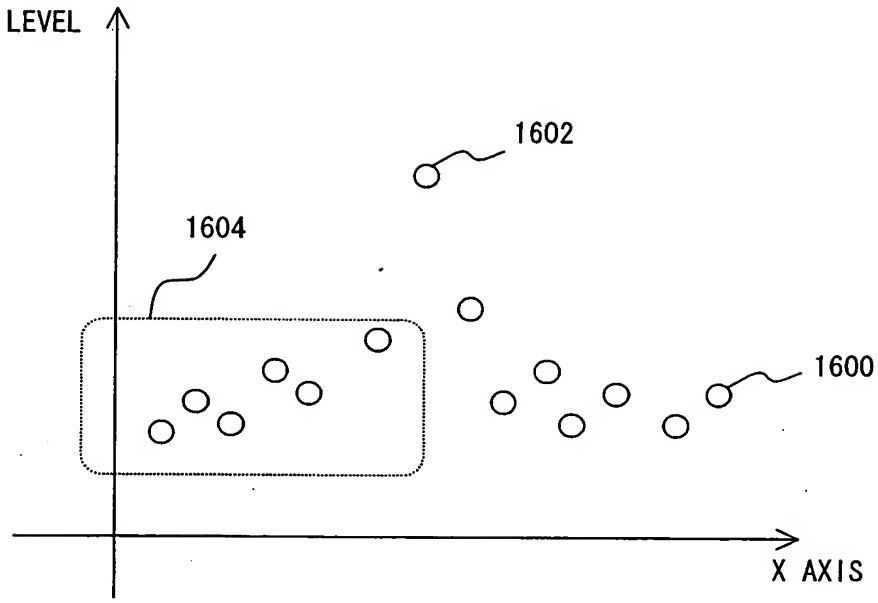


FIG. 16

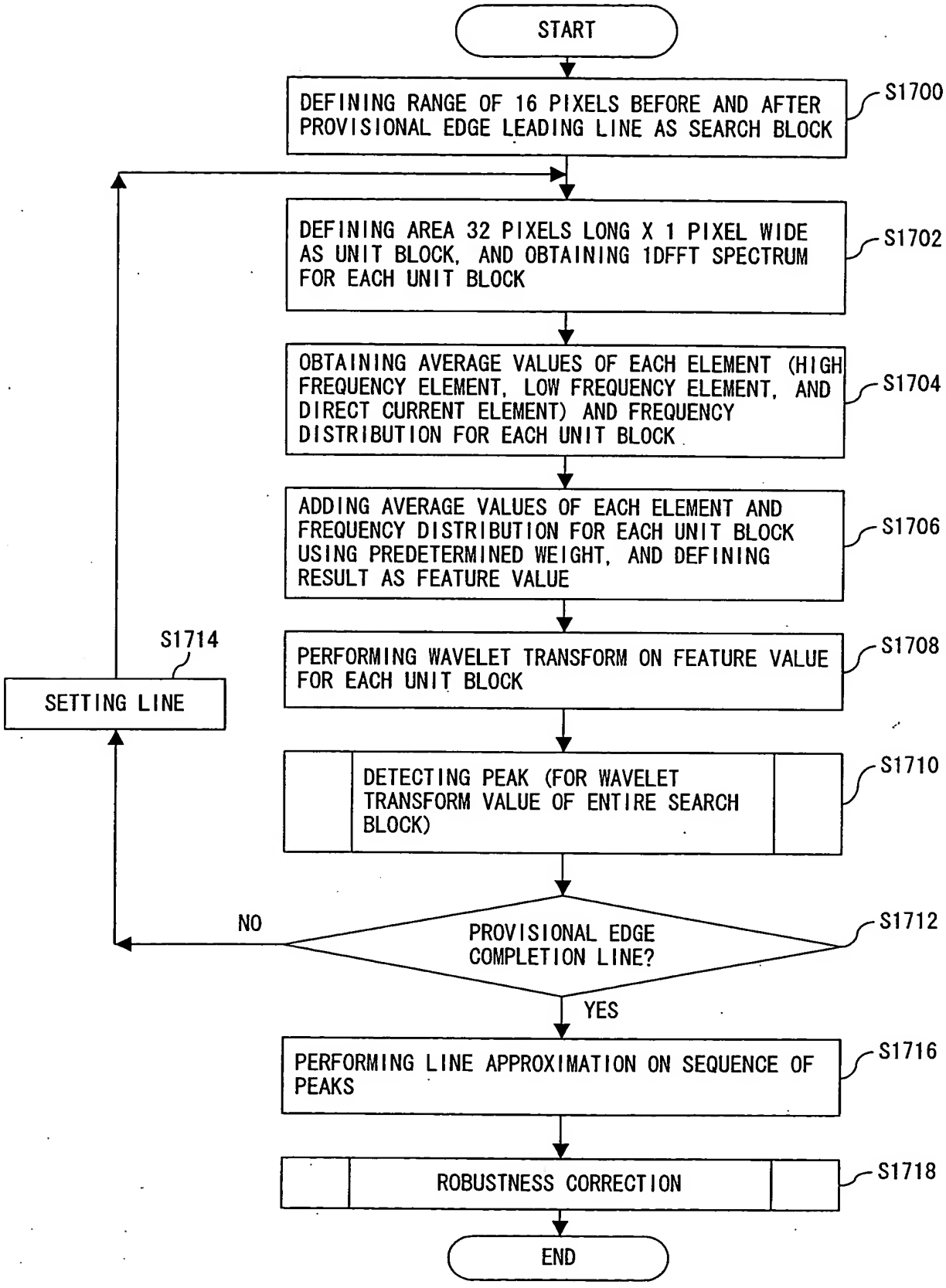

START
DEFINING RANGE OF 16 PIXELS BEFORE AND AFTER PROVISIONAL EDGE LEADING LINE AS SEARCH BLOCK
S1700
DEFINING AREA 32 PIXELS LONG X 1 PIXEL WIDE AS UNIT BLOCK, AND OBTAINING 1DFFT SPECTRUM FOR EACH UNIT BLOCK
S1702
OBTAINING AVERAGE VALUES OF EACH ELEMENT (HIGH FREQUENCY ELEMENT, LOW FREQUENCY ELEMENT, AND DIRECT CURRENT ELEMENT) AND FREQUENCY DISTRIBUTION FOR EACH UNIT BLOCK
S1704
ADDING AVERAGE VALUES OF EACH ELEMENT AND FREQUENCY DISTRIBUTION FOR EACH UNIT BLOCK USING PREDETERMINED WEIGHT, AND DEFINING RESULT AS FEATURE VALUE
S1706
PERFORMING WAVELET TRANSFORM ON FEATURE VALUE FOR EACH UNIT BLOCK
S1708
DETECTING PEAK (FOR WAVELET TRANSFORM VALUE OF ENTIRE SEARCH BLOCK)
S1710
PROVISIONAL EDGE COMPLETION LINE?
S1712
NO
YES
SETTING LINE
S1714
PERFORMING LINE APPROXIMATION ON SEQUENCE OF PEAKS
S1716
ROBUSTNESS CORRECTION
S1718
END

FIG. 17

FIG. 18A

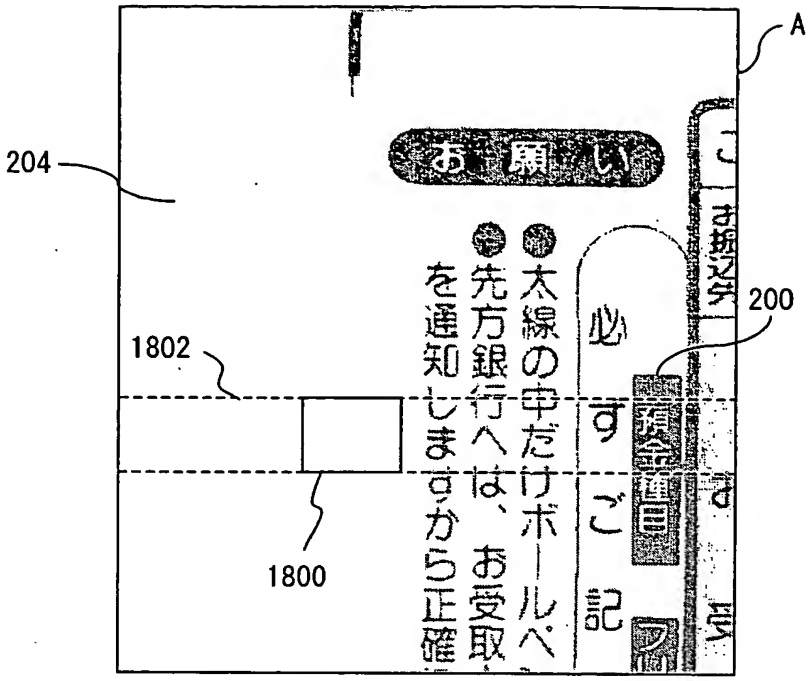


FIG. 18B

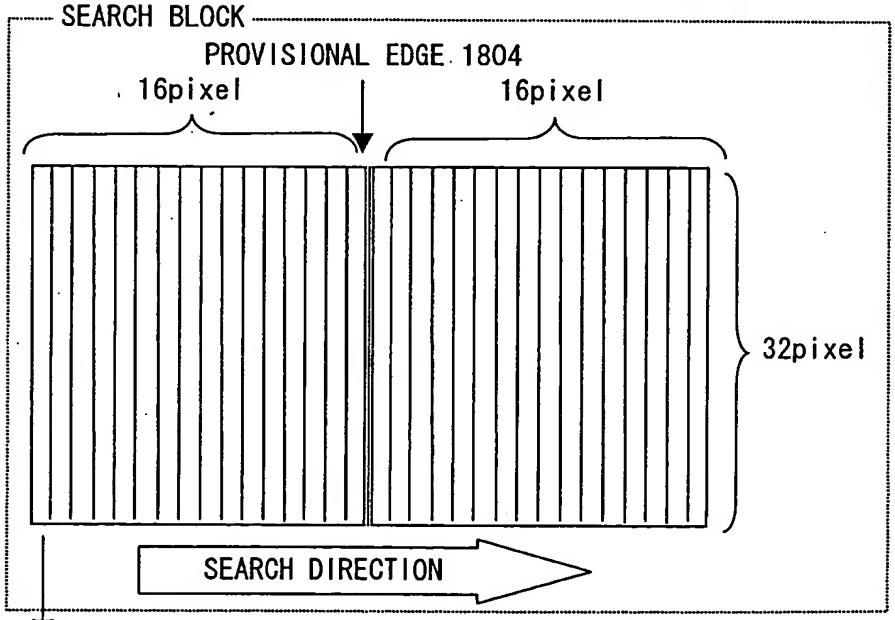
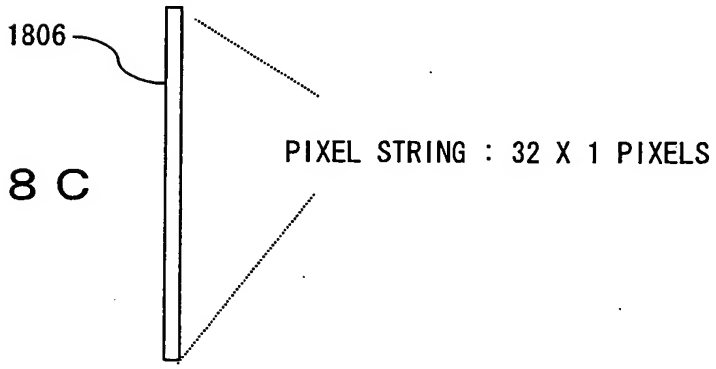


FIG. 18C



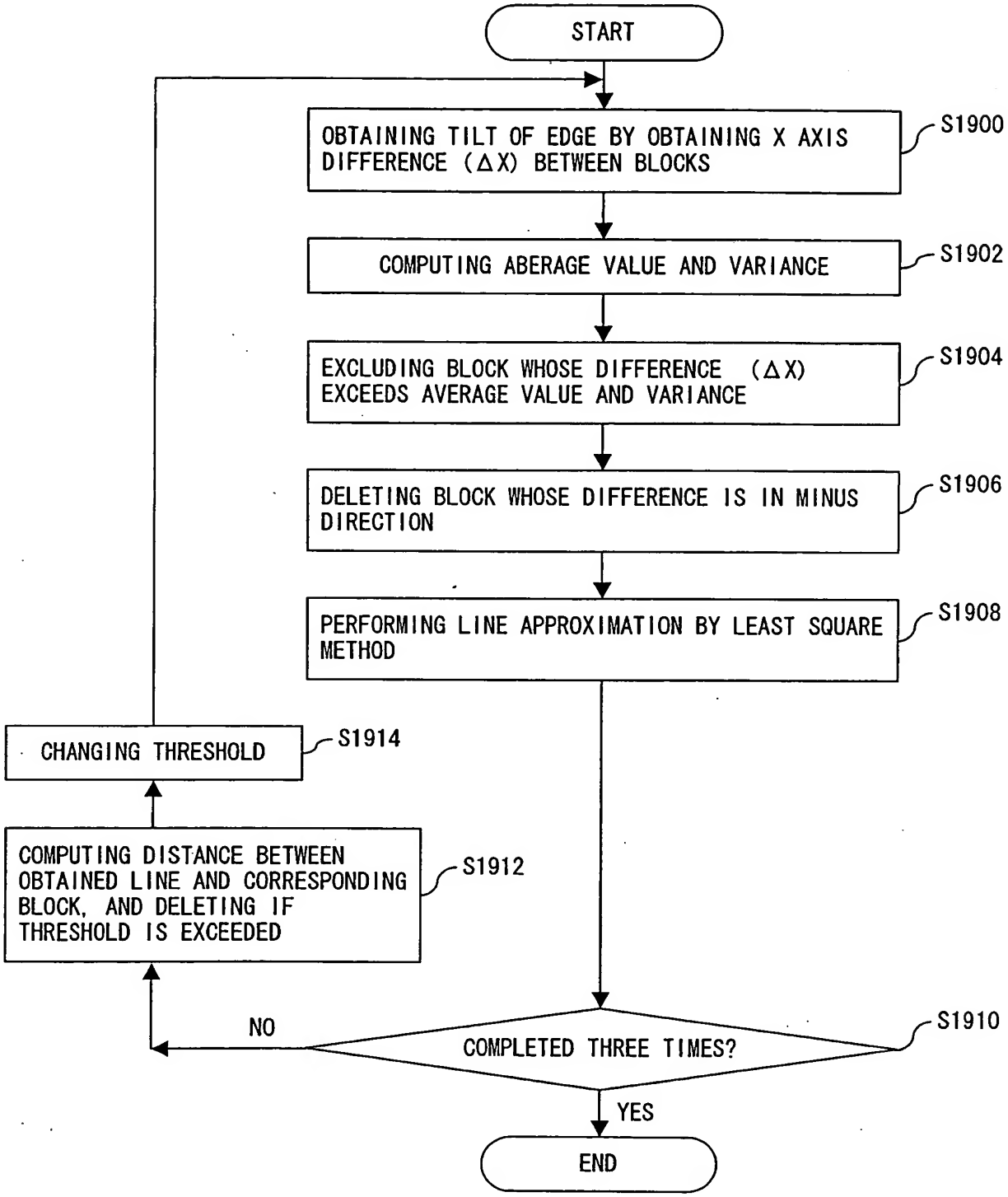

START
OBTAINING TILT OF EDGE BY OBTAINING X AXIS DIFFERENCE (ΔX) BETWEEN BLOCKS
S1900
COMPUTING ABERAGE VALUE AND VARIANCE
S1902
EXCLUDING BLOCK WHOSE DIFFERENCE (ΔX) EXCEEDS AVERAGE VALUE AND VARIANCE
S1904
DELETING BLOCK WHOSE DIFFERENCE IS IN MINUS DIRECTION
S1906
PERFORMING LINE APPROXIMATION BY LEAST SQUARE METHOD
S1908
CHANGING THRESHOLD
S1914
COMPUTING DISTANCE BETWEEN OBTAINED LINE AND CORRESPONDING BLOCK, AND DELETING IF THRESHOLD IS EXCEEDED
S1912
NO
COMPLETED THREE TIMES?
S1910
YES
END

FIG. 19

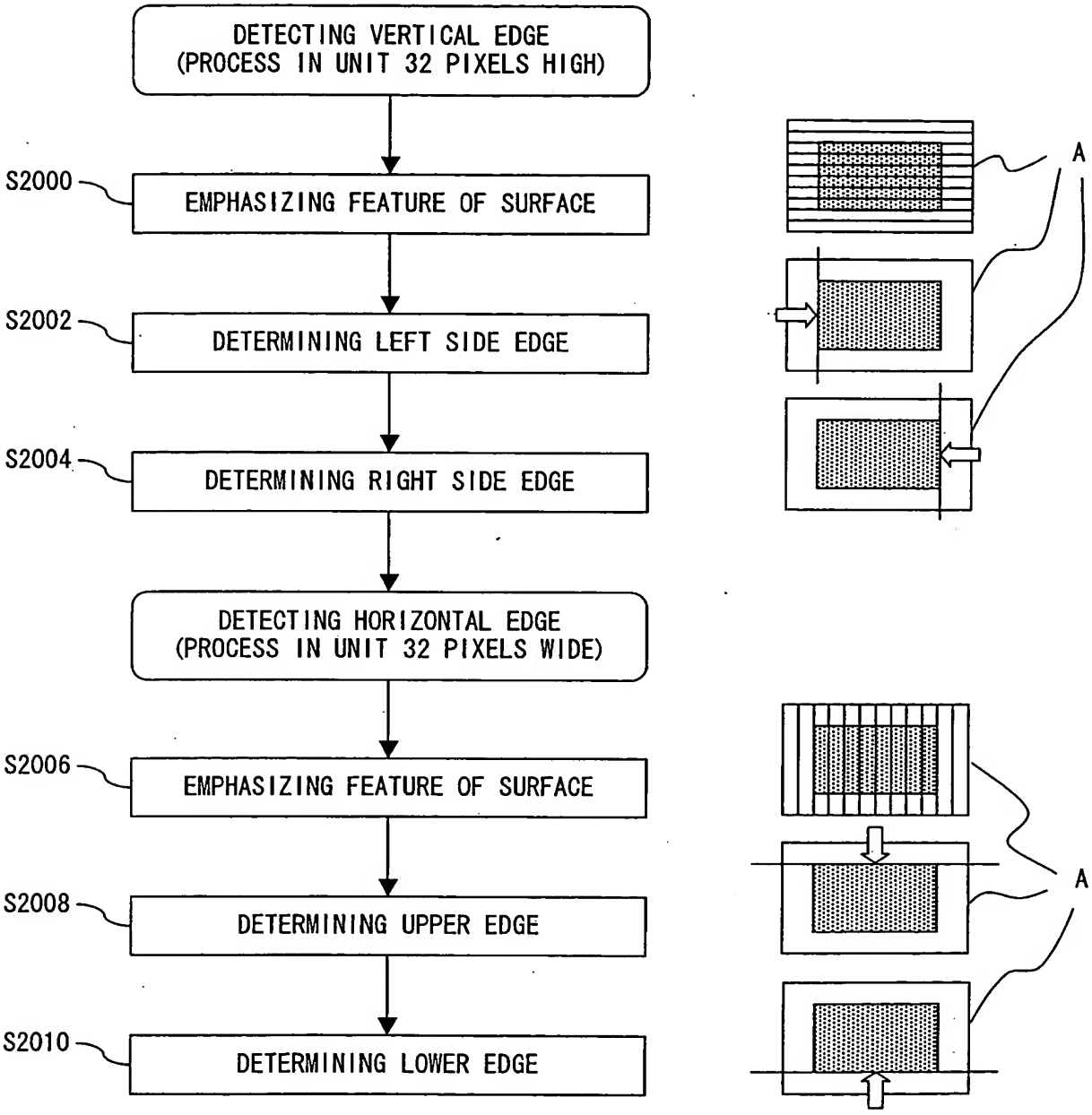

DETECTING VERTICAL EDGE
(PROCESS IN UNIT 32 PIXELS HIGH)
S2000
EMPHASIZING FEATURE OF SURFACE
S2002
DETERMINING LEFT SIDE EDGE
S2004
DETERMINING RIGHT SIDE EDGE
DETECTING HORIZONTAL EDGE
(PROCESS IN UNIT 32 PIXELS WIDE)
S2006
EMPHASIZING FEATURE OF SURFACE
S2008
DETERMINING UPPER EDGE
S2010
DETERMINING LOWER EDGE
A
A

FIG. 20

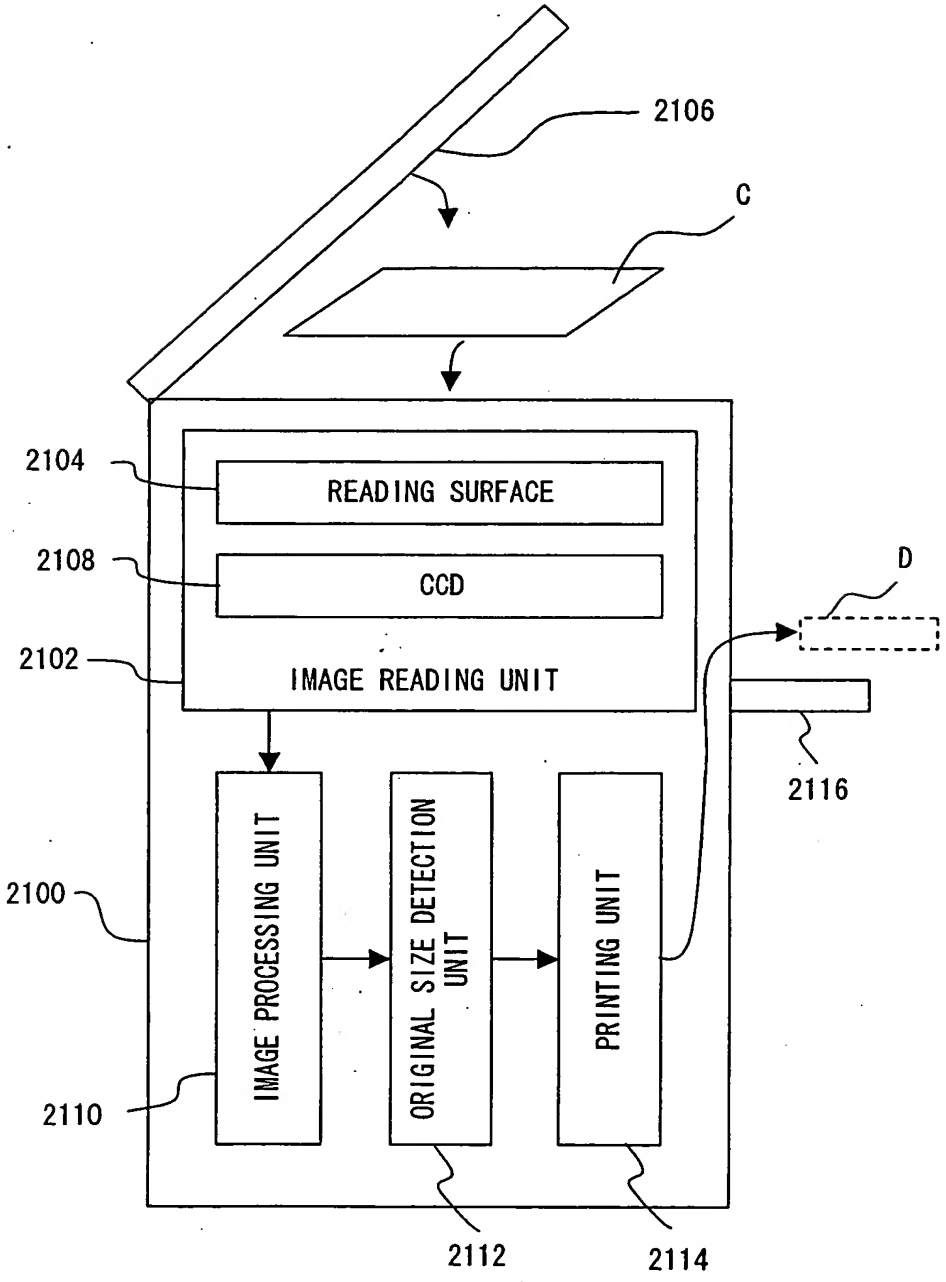

2106
C
2104
READING SURFACE
2108
CCD
D
2102
IMAGE READING UNIT
2116
2100
IMAGE PROCESSING UNIT
ORIGINAL SIZE DETECTION UNIT
PRINTING UNIT
2110
2112
2114

FIG. 21

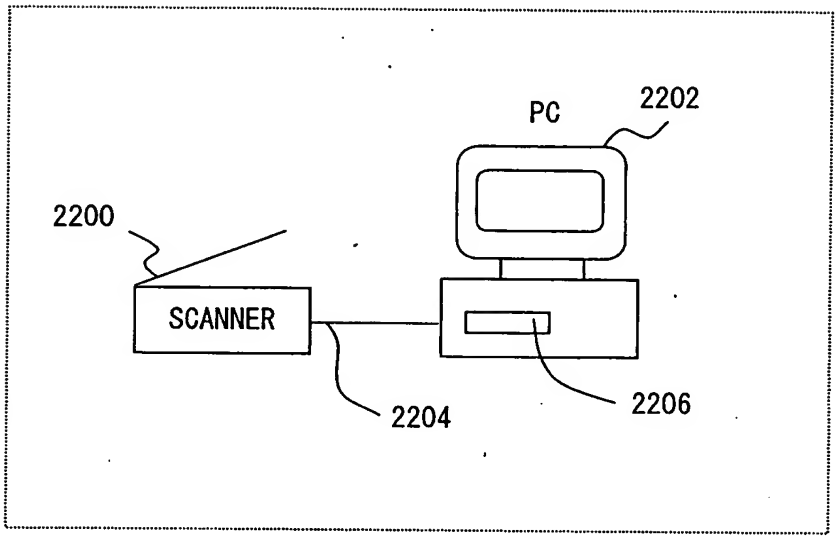


FIG. 22

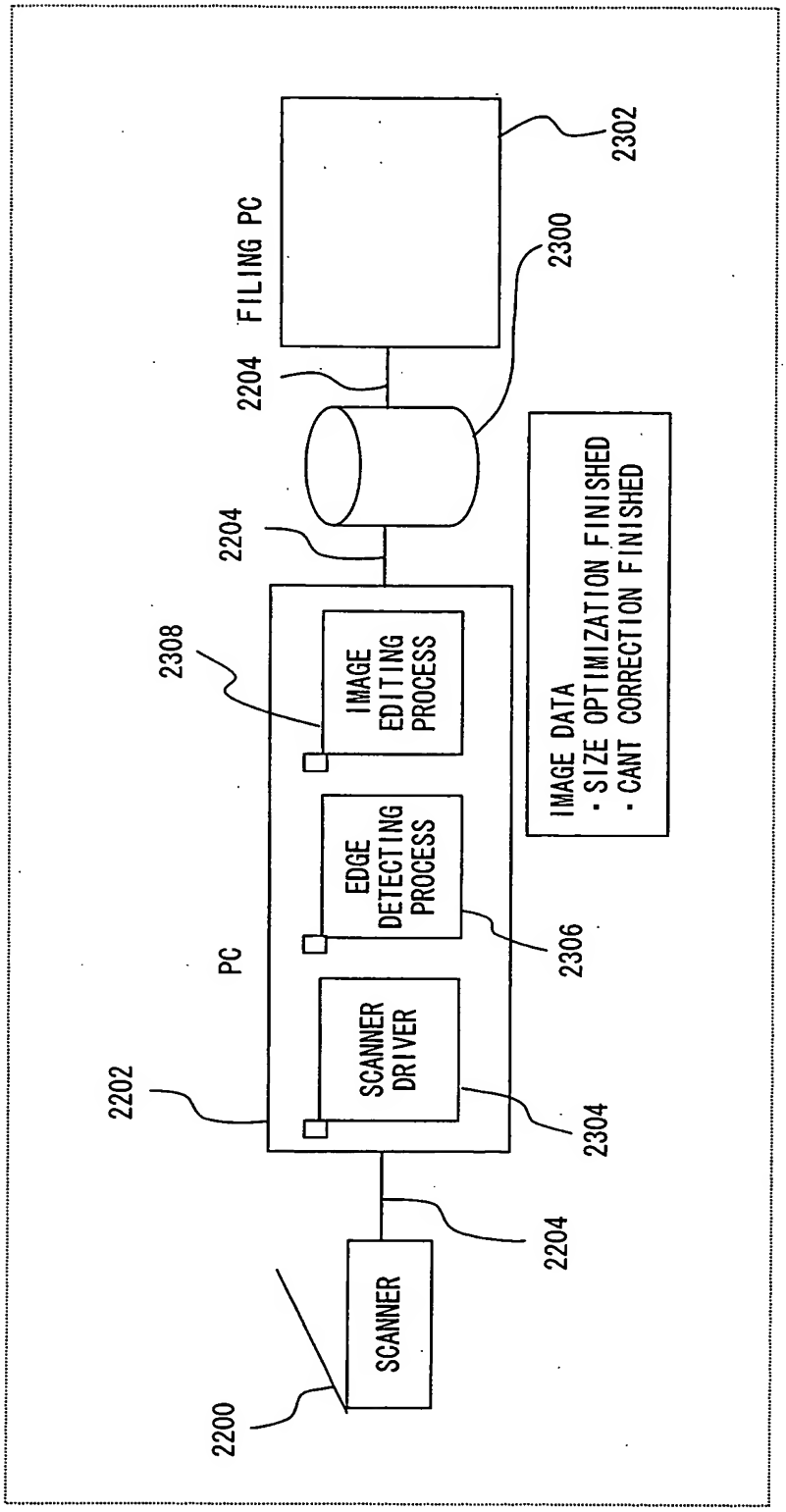

2302
FILING PC
2300
2204
2204
2308
IMAGE EDITING PROCESS
IMAGE DATA
・SIZE OPTIMIZATION FINISHED
・CANT CORRECTION FINISHED
EDGE DETECTING PROCESS
2306
PC
SCANNER DRIVER
2202
2304
2204
SCANNER
2200

FIG. 23

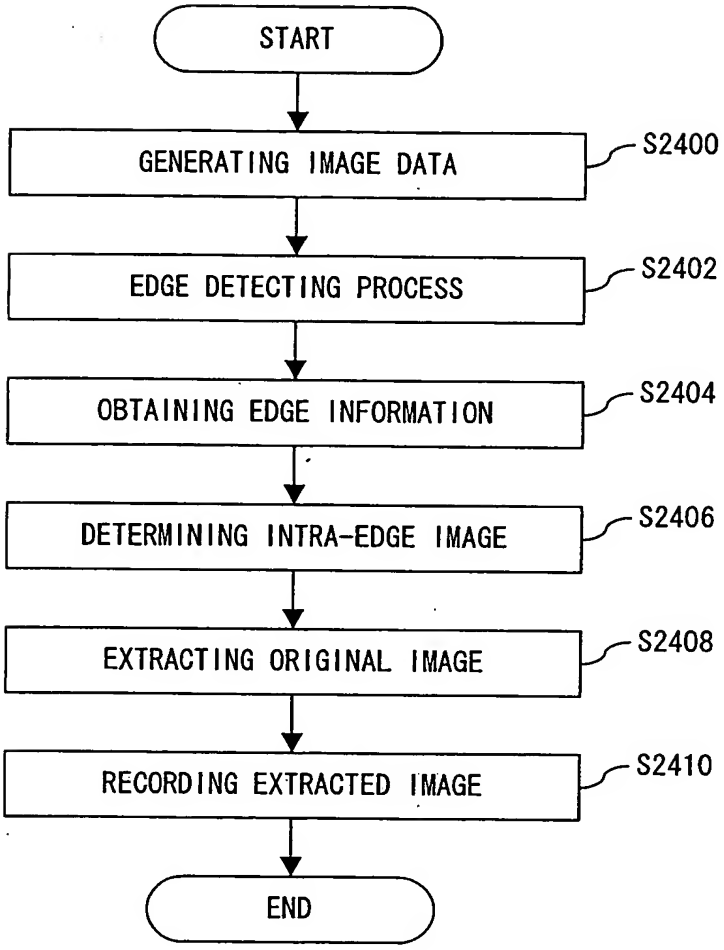

START
GENERATING IMAGE DATA
S2400
EDGE DETECTING PROCESS
S2402
OBTAINING EDGE INFORMATION
S2404
DETERMINING INTRA-EDGE IMAGE
S2406
EXTRACTING ORIGINAL IMAGE
S2408
RECORDING EXTRACTED IMAGE
S2410
END

FIG. 24

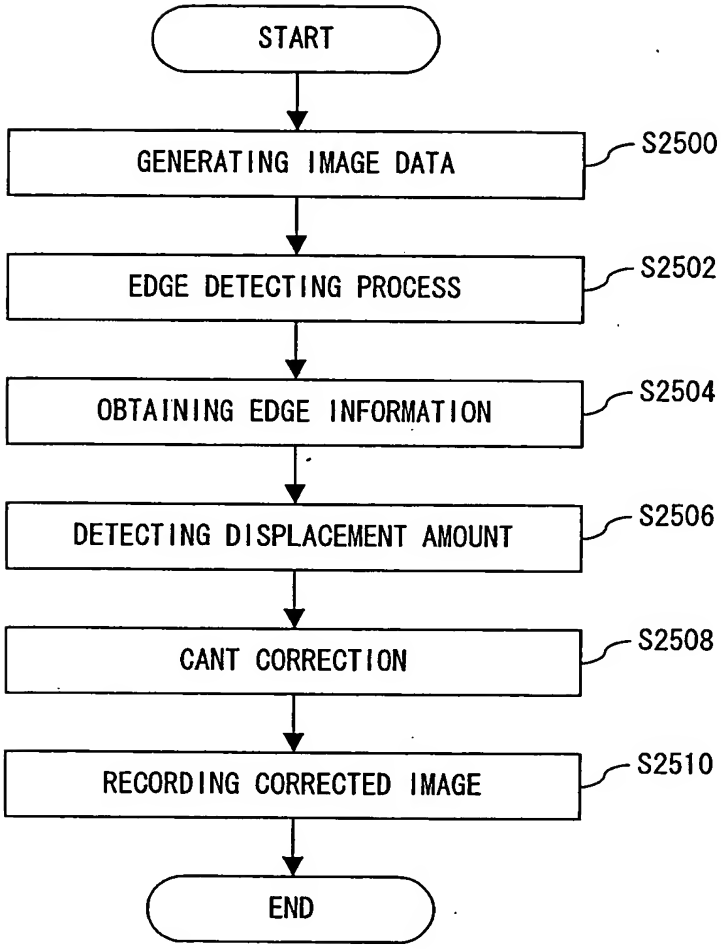

START
GENERATING IMAGE DATA
S2500
EDGE DETECTING PROCESS
S2502
OBTAINING EDGE INFORMATION
S2504
DETECTING DISPLACEMENT AMOUNT
S2506
CANT CORRECTION
S2508
RECORDING CORRECTED IMAGE
S2510
END

FIG. 25

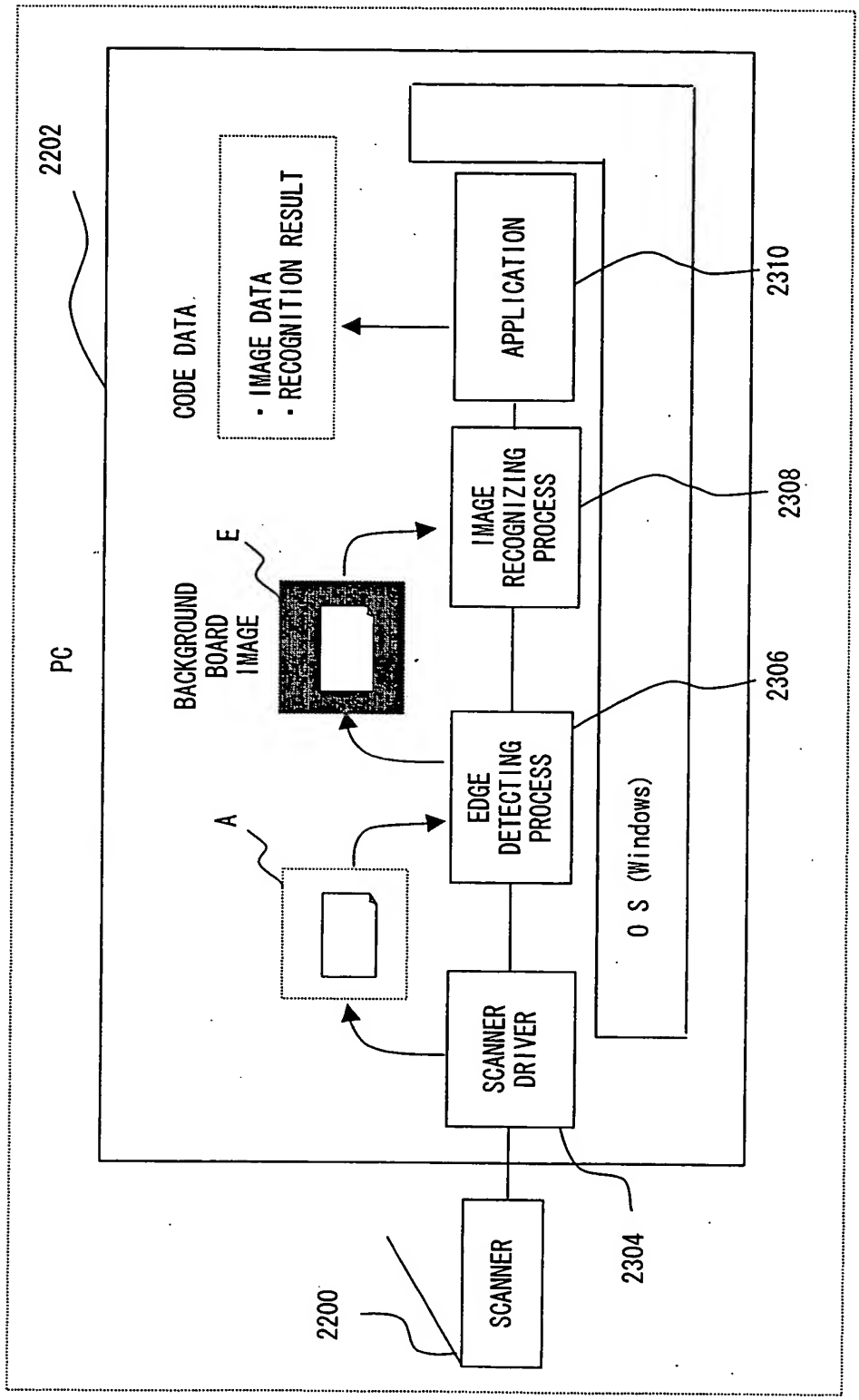

2202
PC
CODE DATA
• IMAGE DATA
• RECOGNITION RESULT
APPLICATION
2310
IMAGE RECOGNIZING PROCESS
2308
BACKGROUND BOARD IMAGE
E
EDGE DETECTING PROCESS
2306
A
SCANNER DRIVER
O S (Windows)
SCANNER
2200
2304

FIG. 26

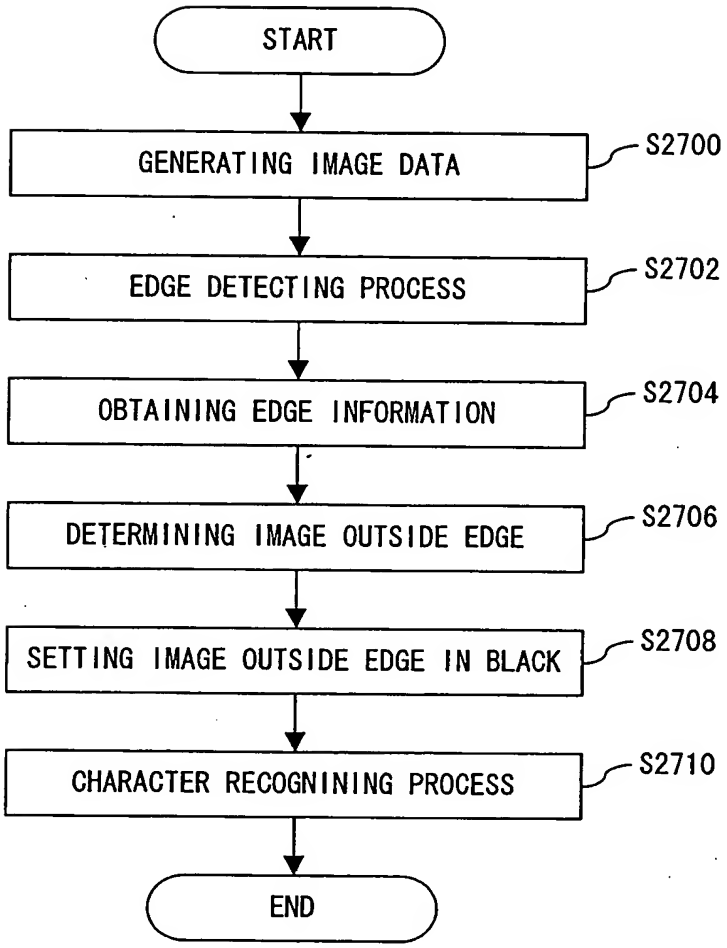

START
GENERATING IMAGE DATA
S2700
EDGE DETECTING PROCESS
S2702
OBTAINING EDGE INFORMATION
S2704
DETERMINING IMAGE OUTSIDE EDGE
S2706
SETTING IMAGE OUTSIDE EDGE IN BLACK
S2708
CHARACTER RECOGNINING PROCESS
S2710
END

FIG. 27